Pilot-Scale Research at NETL on Mercury Measurement and Control

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NETL

Mercury Control Technology R&D Program Review Meeting

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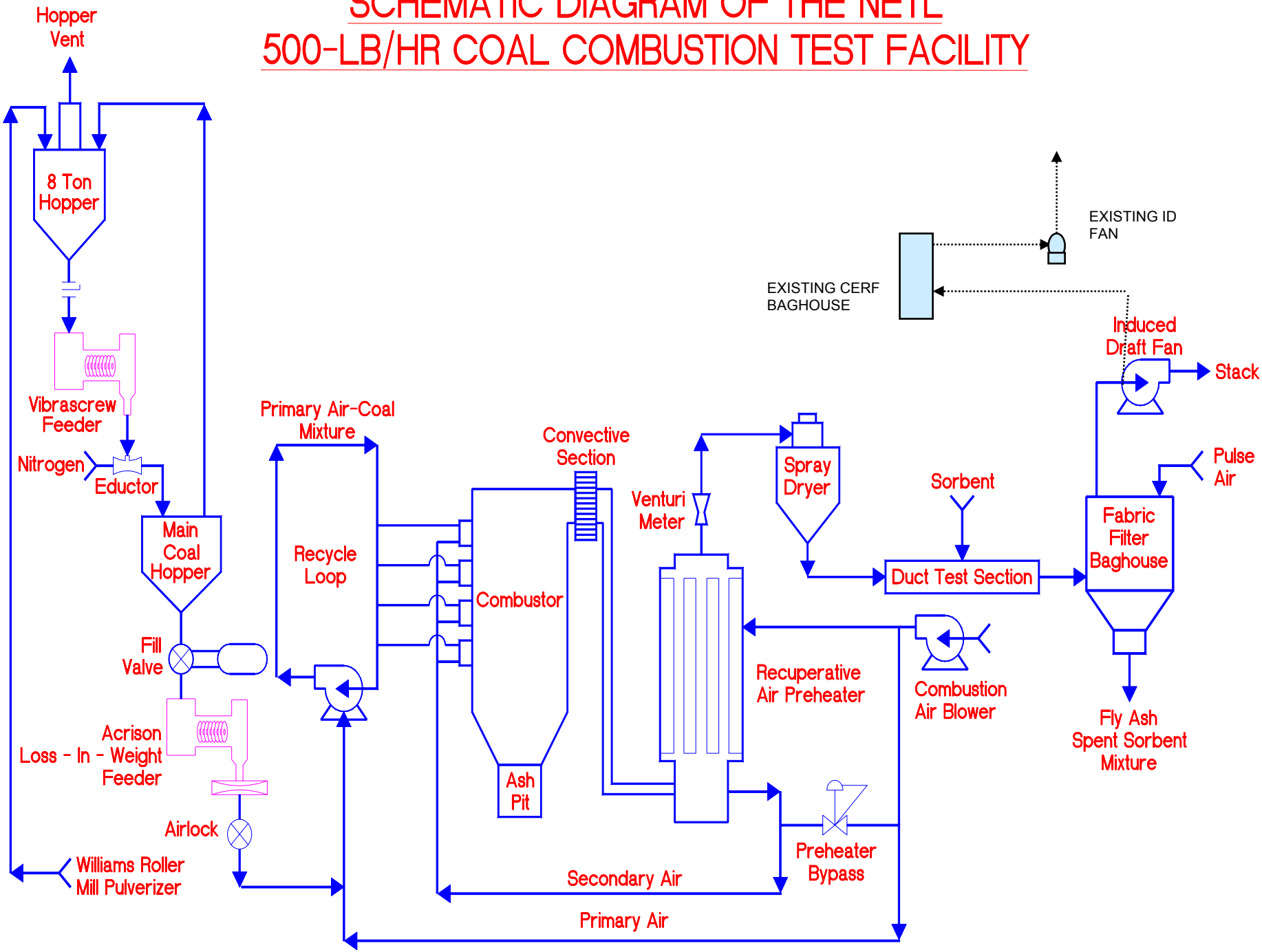
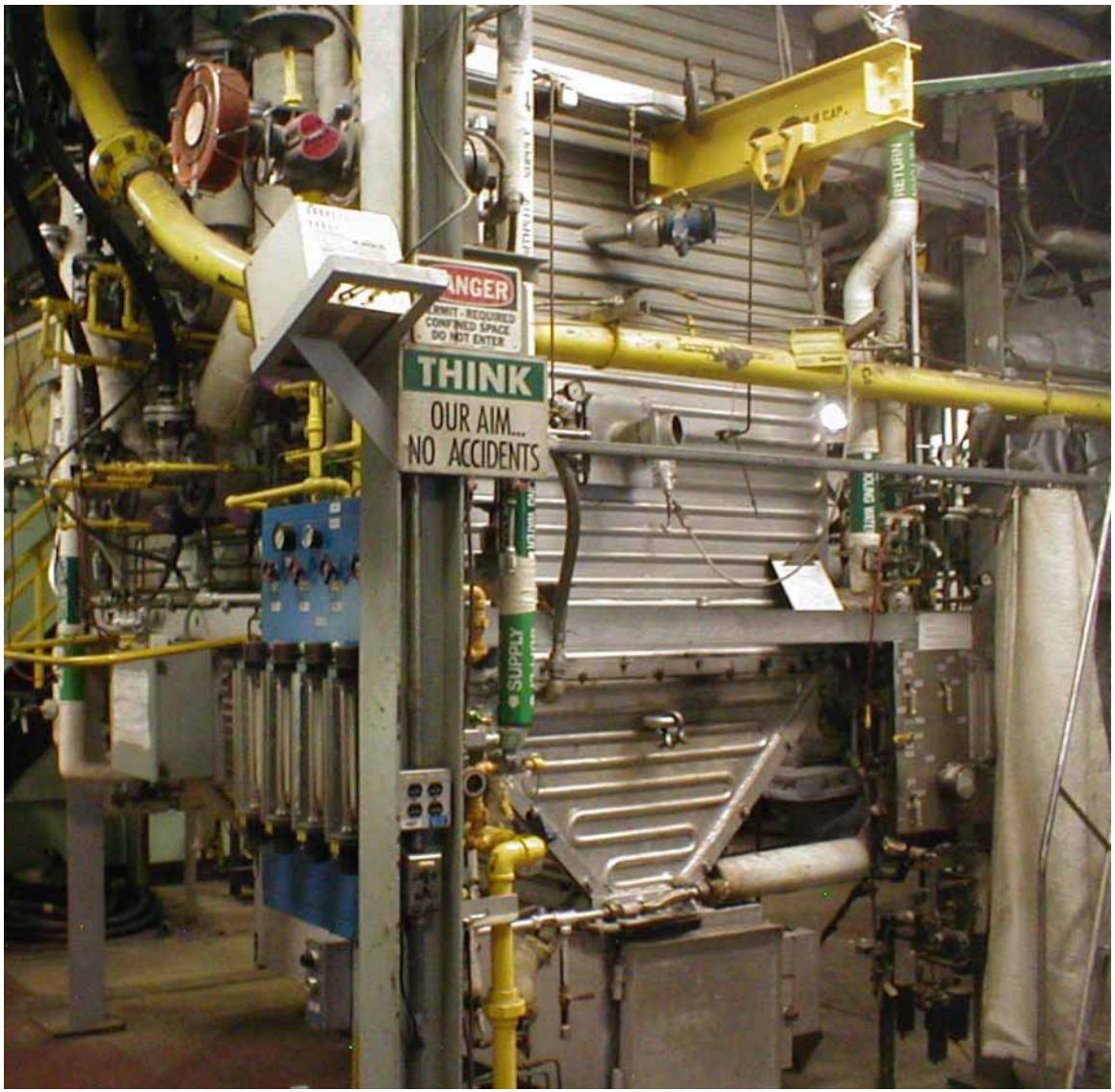
Project Objectives

- Conduct testing to assess the Hg removal performance of activated carbon and novel sorbents for a range of coals and blends
- Evaluate methods for measurement of mercury concentration and speciation
- Provide for testing of novel Hg removal methods (e.g. Thief, GP-254)
- Use test data for model development and validation

SCHEMATIC DIAGRAM OF THE NETL 500-LB/HR COAL COMBUSTION TEST FACILITY



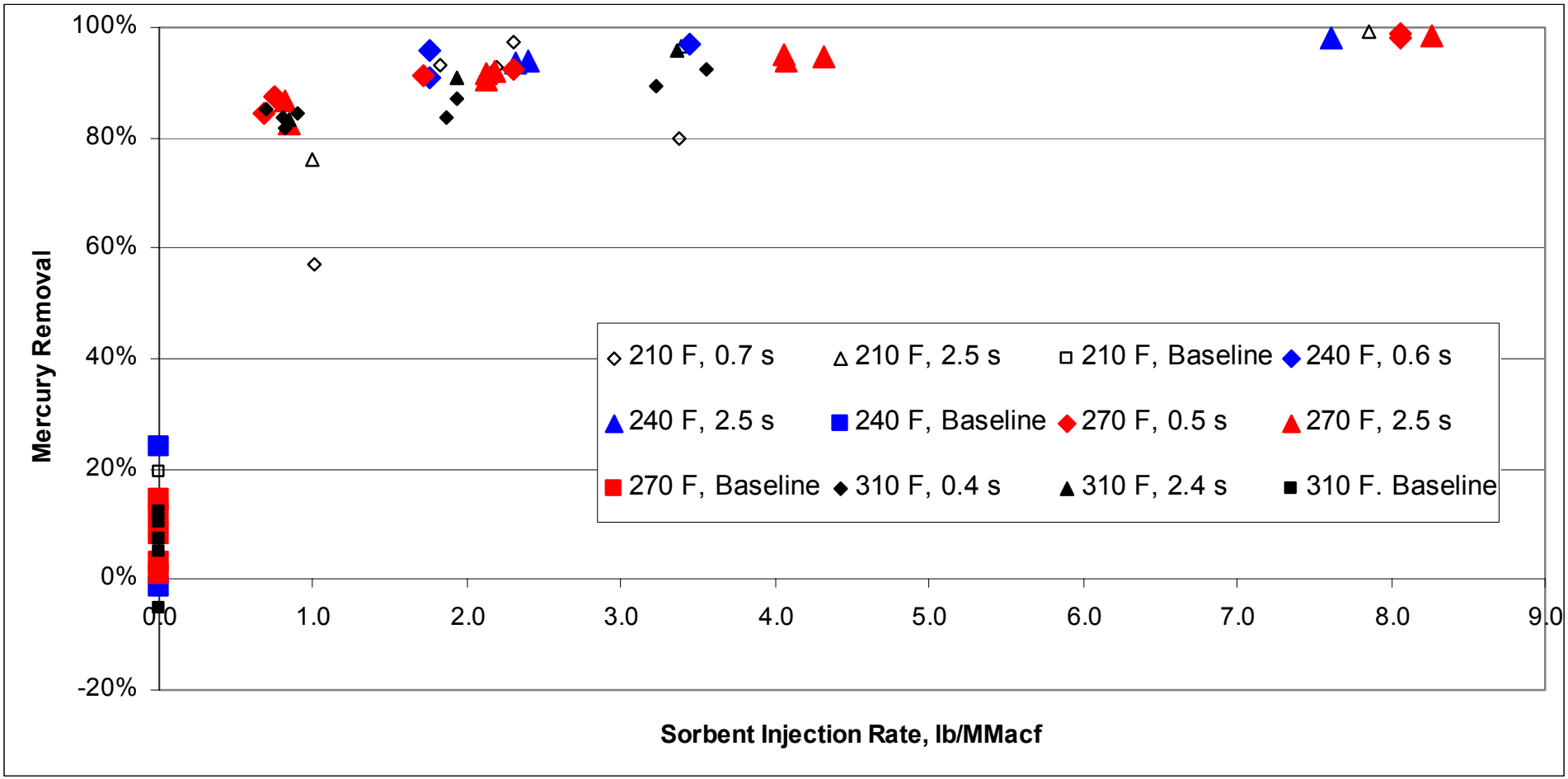
500 lb/hr Combustor



Hg Speciation-PRB Coal w/o Sorbent Injection

- **PRB coal from Pleasant Prairie Power Plant**
  - Pleasant Prairie Power Plant–84.5% elemental Hg
    9.8% oxidized Hg
    5.7% particulate Hg
  - NETL 500lb/hr unit (N=34) - 79.2% elemental Hg
    20.8% oxidized Hg

Baghouse Hg Removal Efficiency - PRB Coal

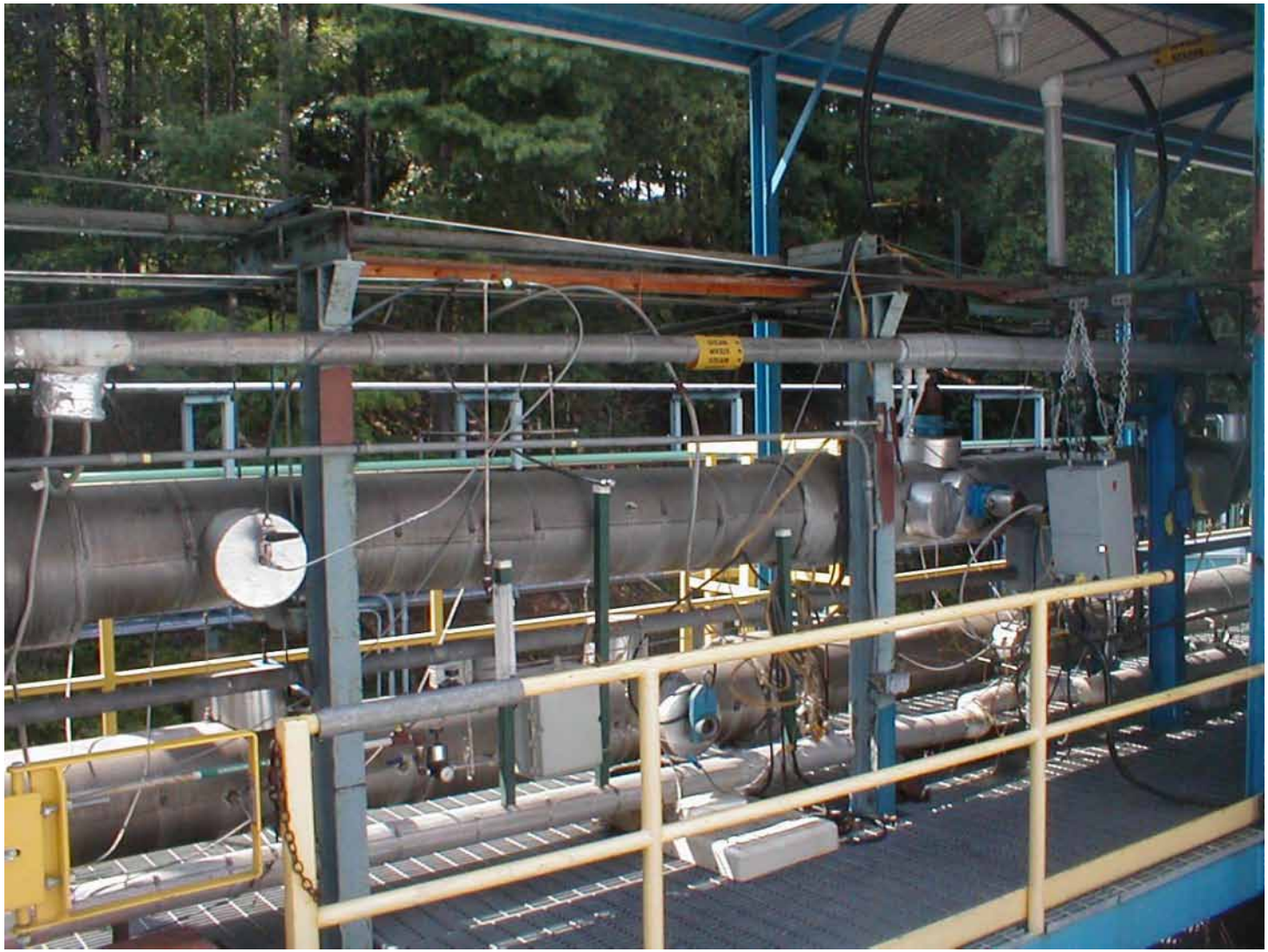


In-Duct Hg Removal Performance of Norit Darco FGD

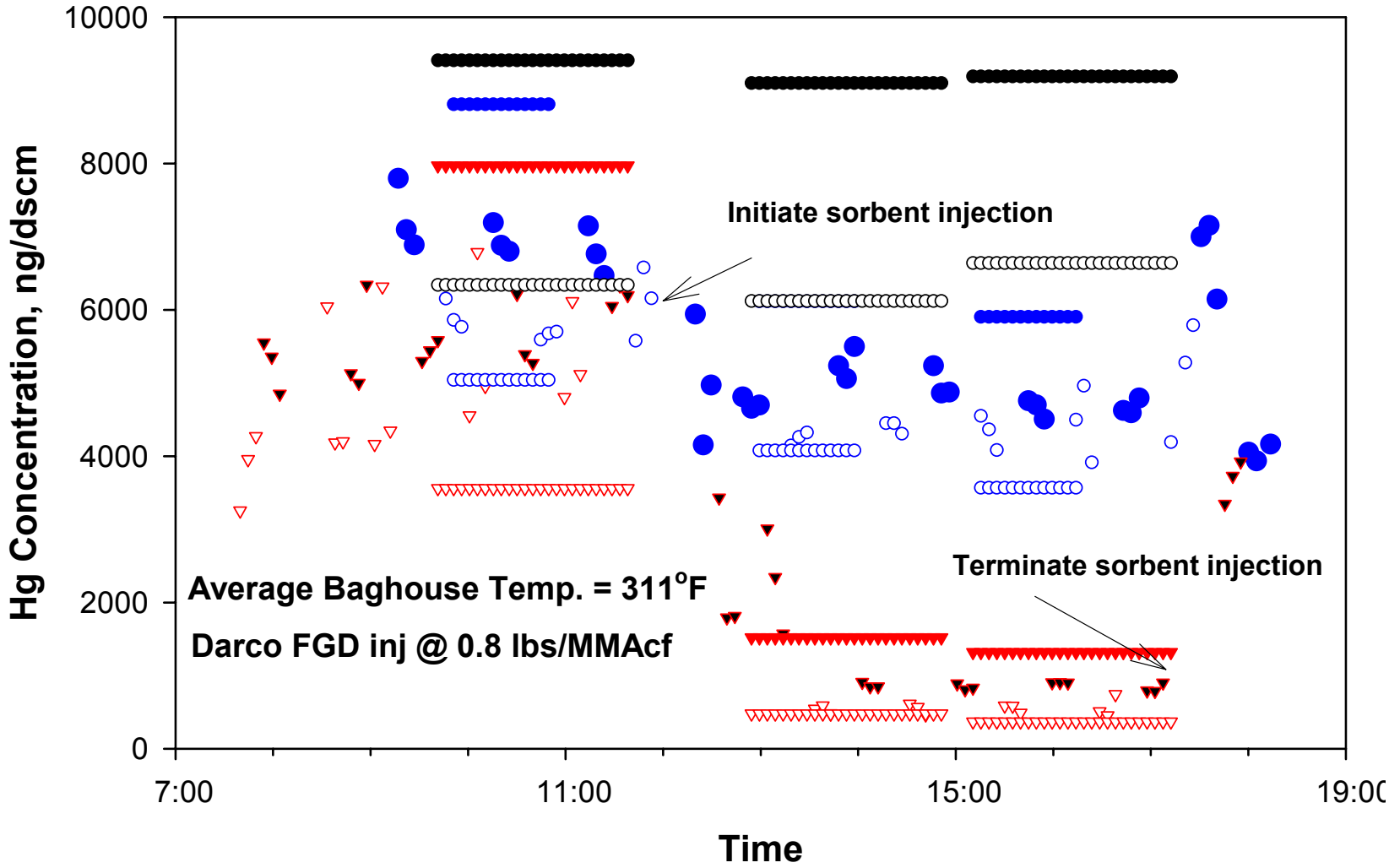
Baghouse Inlet Sampling Configuration

Spray Injection Duct

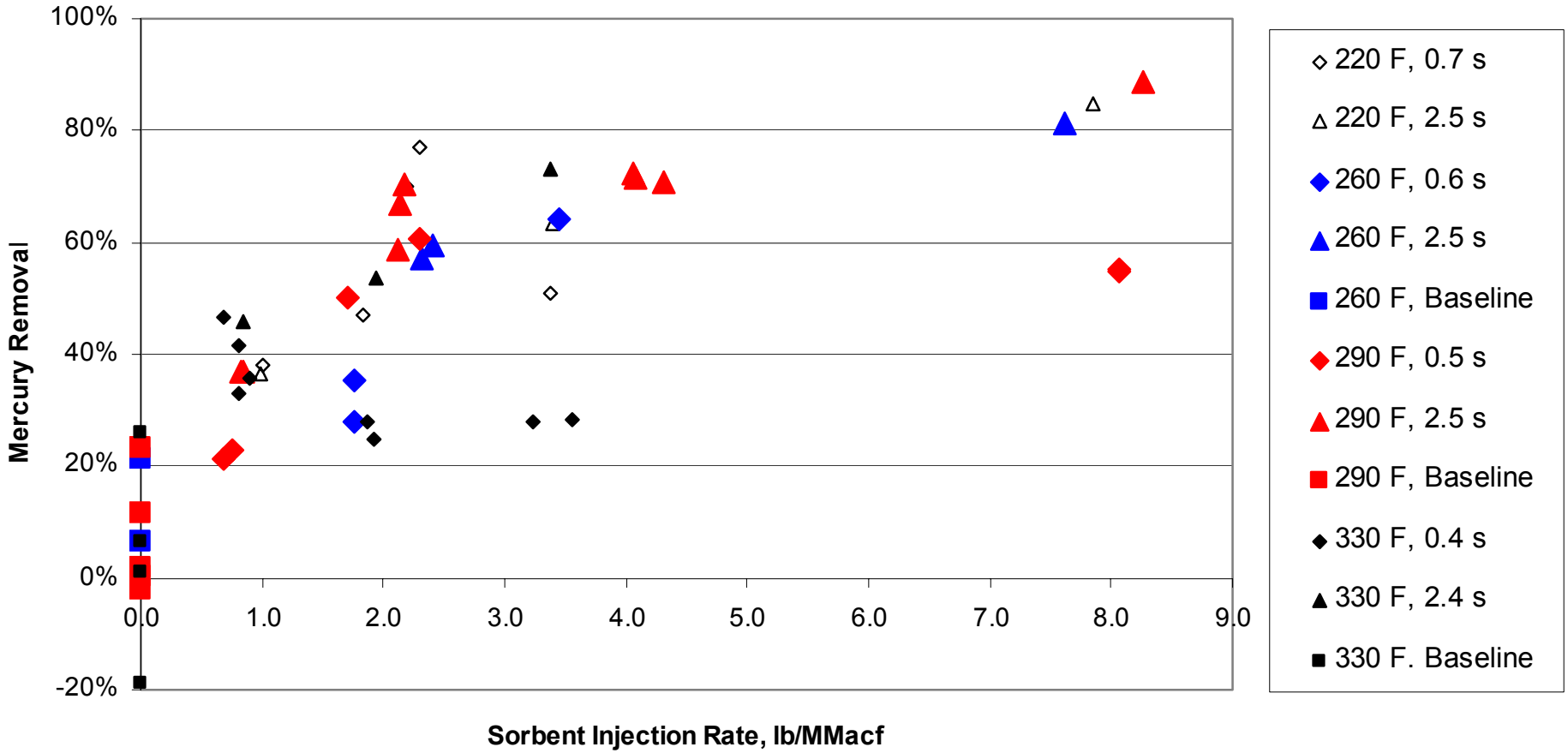
Spray Injection Duct Sampling Location



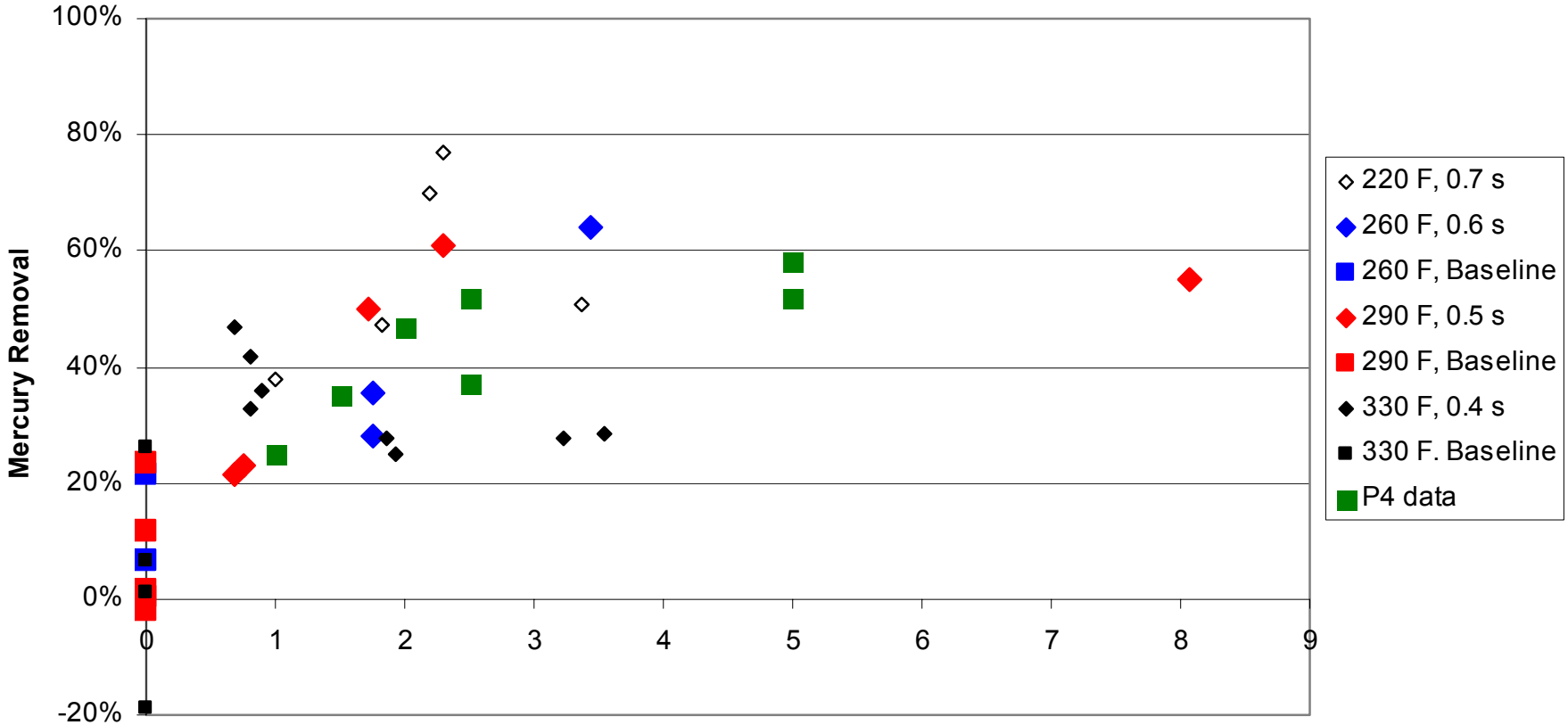
Typical Hg Sampling Day



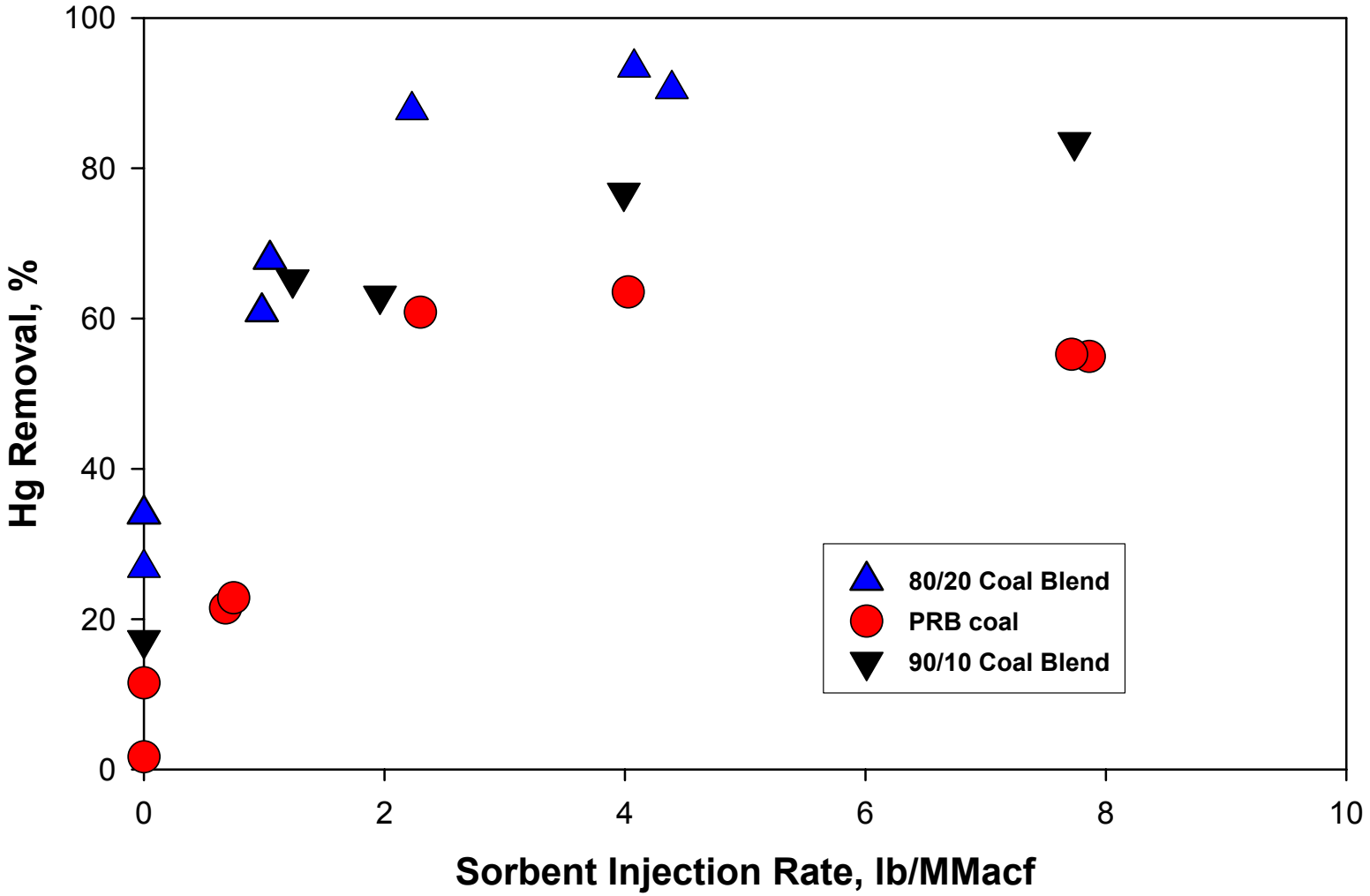
In-Duct Hg Removal Efficiency – PRB Coal



In-Duct Hg Removal – Short Residence Time



Impact of Coal Blending on Hg Removal



Impact of Blending on Hg Speciation / HCl

- **EPA method 26A – HCl**
  - PRB 1.4 - 2.4 ppmv
  - 90/10 blend 5.7 – 7.4 ppmv
- **Hg speciation Ontario-Hydro**
  - PRB 20.8% Hg^{2+}
  - 90/10 blend 86.5% Hg^{2+}
  - 80/20 blend 91% Hg^{2+}
- **LOI**
  - PRB 0.5% (0.45-0.59)
  - 90/10 0.6% (0.51-0.76)
  - 80/20 0.4% (0.30-0.52)

Thief Process

- An alternative technique to activated carbon injection for Hg removal
- Process involves extracting partially combusted coal from the combustor and re-injecting downstream of the air preheater
- Lower cost than activated carbon sorbents
- Patent No. 6,521,012 issued February 18, 2003
- Current interest for commercial development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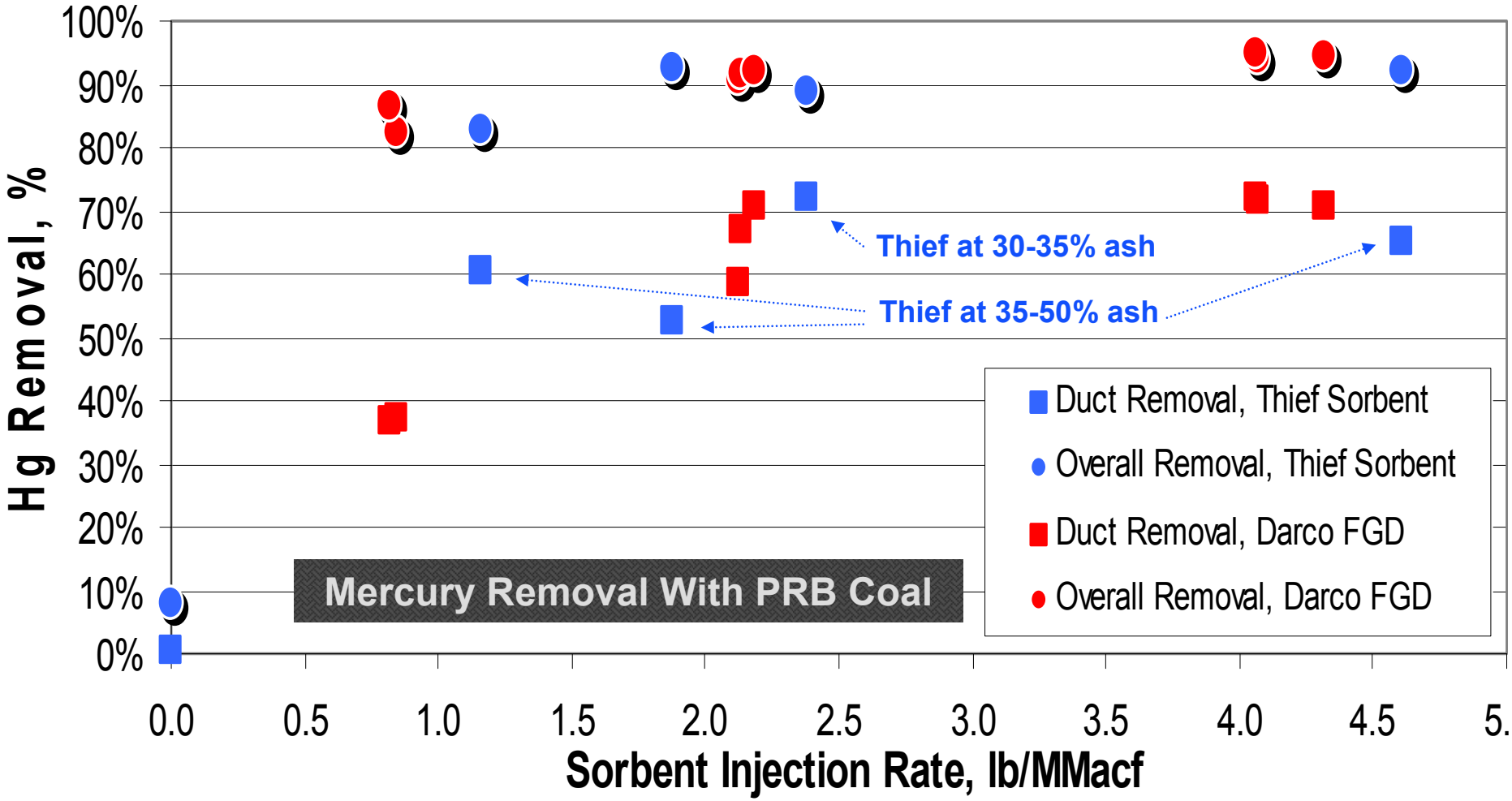
Mercury Removal Results - Darco FGD vs. Thief Sorbent



Baghouse 270°F **Sorbent Duct Residence Time 2.5 sec**

Conclusions

- 500 lb/hr pilot combustor baseline speciation and activated carbon removal efficiency are very similar to full-scale testing results
- Higher Hg removals obtained with PRB coal by increasing sorbent residence time above 0.5 seconds
- Impact of residence time on in-duct removal efficiency greater at higher temperatures

Conclusions

- In-house novel process (Thief) shows comparable removals to activated carbon at lower cost
- Initial results of blending indicate higher Hg removals from addition of small percentage of bituminous coal

Work in Progress

- Complete testing bituminous/PRB coal blends
- Thief process
- Hg control for lignite coals

Questions ?